

NATIONAL SCIENCE OLYMPIAD

The actual test paper has 50 questions. Time allowed : 60 minutes. There are 2 sections, 20 questions in section I and 30 in section II.

SYLLABUS

Section – I (Mathematics) : Linear equations in two variables, Polynomials, Rational expressions, Quadratic equations, Arithmetic progressions (A.P), Installments, Income tax, Similar triangles, Circles, Constructions, Mean, Probability, Pictorial representation of data, Coordinate geometry, Sets, Relations and functions logarithms, Geometrical progressions, Trigonometry, Binomial theorem & permutation combination.

OR

Section – I (Biology) : Living world, Diversity of life, Cell & cell division, Genetics, Morphology of plants & animals.

Section – II (Physics & Chemistry) : *Physics*: Units & measurements, Mechanics, Properties of matter, Heat & thermodynamics, Oscillation, Waves.

Chemistry: Basic concepts of chemistry, States of matter, Atomic structure & chemical bonding, Classification of element & periodicity, Equilibrium, Extraction of elements, Hydrogen, s & p block elements, Carbon & its compounds, Hydrocarbons.

MATHEMATICS

1. A man moving on a parabolic path finds the angle of elevation of a pole, standing on the focus of path, to be 75° . If the directrix of path is at a distance of 7 meters from him then height of pole is
(A) $(14 + 7\sqrt{3})$ mtr. (B) $\frac{(2 + \sqrt{3})}{7}$ mtr. (C) $(14 - 7\sqrt{3})$ mtr. (D) $\frac{(2 - \sqrt{3})}{7}$ mtr. (E) None of these.
2. Three ladies have each brought a child for admission to a school. The head of the school wishes to interview the six people one by one, taking care that no child is interviewed before its mother. The number of ways of doing this is
(A) 6 (B) 36 (C) 72 (D) 90 (E) None of these.
3. A refrigerator is offered for sale at Rs. 250.00 with successive discounts of 20% and 15%. The sale price of the refrigerator is:
(A) 35% less than Rs. 250.00 (B) 65% of Rs. 250.00
(C) 77% of Rs. 250.00 (D) 68% of Rs. 250.00 (E) None of these.
4. The number of revolutions of a wheel, with fixed center and with an outside diameter of 6 m, required to cause a point on the rim to go one km is
(A) 880 (B) $440/\pi$ (C) $500/3\pi$ (D) 440π (E) None of these.

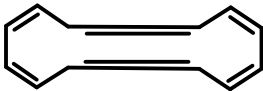
OR

BIOLOGY

1. Which of the following statements are true for photosynthetic bacteria (PB) and chemosynthetic bacteria (CB)?
(a) obtain energy from the oxidation of inorganic molecule such as ammonium salt
(b) obtain energy from sunlight (c) contain photosynthetic pigments
(d) are autotrophs.
(A) PB - b, c, d ; CB - a, d (B) PB - a, c ; CB - b, d
(C) PB - b, d ; CB - a, b (D) PB - a, b, c ; CB - b, c, d (E) None of these.
2. Anaerobic respiration release less energy than aerobic respiration because
(A) energy from oxygen is not made available (B) ethyl alcohol is a source of energy
(C) carbon dioxide is released
(D) less energy is required by fermenting organisms (E) None of these.
3. Three bean seedlings were grown in three culture solutions. After six weeks, X had yellow leaves and short internodes, Y has red patches on the stem and Z had green leaves and stem. It can be deduced that
(A) X lacked magnesium, Y lacked calcium and Z lacked molybdenum
(B) X lacked calcium, Y lacked nitrogen and Z lacks chlorine
(C) X lacked calcium, Y lacked nitrogen and Z had all nutrients
(D) X lacked magnesium, Y lacked nitrogen and Z contains all nutrients (E) None of these.
4. In the life cycle of a fern the meiosis occurs during the
(A) Formation of spores (B) Formation of gametes
(C) Germination of a spore (D) Development of a zygote (E) None of these.

PHYSICS & CHEMISTRY

5. Hydrogen sulphide (H_2S) contains 94.11% sulphur, water (H_2O) contains 11.11% hydrogen and sulphur dioxide (SO_2) contains 50% oxygen. Find the ratio of all given elements. After your calculations which law has been verified?
(A) Law of multiple proportion (B) Law of reciprocal proportion
(C) Law of constant components (D) Law of combining volumes (E) None of these.
6. An astronaut in the space shuttle orbiting the earth performs a trick for a television audience. She inflates a helium filled balloon within the shuttle's controlled atmosphere and lets go of it. To the astonishment of all watching, the balloon
(A) Hovers in place where it was released. (B) Rises noticeably away from the earth.
(C) Falls noticeably towards the earth.
(D) Drifts backwards opposite to the direction of the shuttle's velocity. (E) None of these.
7. A boy throws a table tennis ball of mass 20 g upwards with a velocity of $u_0 = 10$ m/s at an angle θ_0 with the vertical. The wind imparts a horizontal force of 0.08 N, so that the ball returns to the starting point. Then, the angle θ_0 must be such that, $\tan \theta_0$ is
(A) 0.2 (B) 0.4 (C) 2.5 (D) 1.2 (E) None of these.
8. A weight is attached to the free end of a sonometer wire. It gives resonance at a length 40 cm when it is resonanced with a tuning fork of frequency 512. The weight is then immersed wholly in water, the resonant length is reduced to 30 cm. The relative density in which weight suspended is
(A) 16/9 (B) 16/7 (C) 16/5 (D) 16/3 (E) None of these.

9. A tank of water has a pinhole leak in the side, 1 m below the water line. If the tank is open to the atmosphere (air pressure = 1.013×10^5 pa), how fast is the water leaving the pinhole ?
 (A) $\sqrt{g/4}$ (B) $\sqrt{g/0.1}$ (C) $\sqrt{2g}$ (D) \sqrt{g} (E) None of these.
10. Find the correct statement from the following.
 (A) In planetary motion, total energy remains constant but total angular momentum may vary
 (B) Both total energy and total angular momentum are constant in planetary motion and the total energy is negative
 (C) Motion of a planet about the Sun and motion of an electron about an attracting nuclear centre are governed by identical relations and the total energy is always positive in both cases
 (D) Both total energy and total angular momentum are constant in planetary motion and the total energy is positive
 (E) None of these.
11. One mole of an ideal monatomic gas expands till its temperature doubles under the process $V^2T = \text{constant}$. If the initial temperature is 400 K, the work done by the gas is
 (A) $400R$ (B) $200R$ (C) $-200R$ (D) Indeterminate (E) None of these.
12. A projectile is thrown such that its range should be 1000 metres, but at highest point it breaks into two equal masses, one of whom falls vertically downwards. The other mass will fall at a distance
 (A) 1500 metres from launching point (B) 2000 metres from launching point
 (C) 3000 metres from launching point (D) 2500 metres from launching point (E) None of these.
13. A spirit level containing a bubble in a liquid is jerked forward. Relative to the level and liquid the bubble moves
 (A) Backwards, due to its inertia; (B) Backwards, due to a pressure gradient in the liquid;
 (C) Forwards, due to its inertia; (D) Forwards, due to a pressure gradient in the liquid;
 (E) Not at all. The bubble and liquid move together.
14. The fourth state of matter is
 (A) Super fluid (B) Plasma (C) Liquid crystals (D) Small particles suspended in the gas
 (E) None of these.
15. The use of ^{12}C scale has superseded the older scale at atomic mass based on ^{16}O isotope, one important advantage of the former being
 (A) The atomic masses on ^{12}C scale became whole number
 (B) ^{12}C is more abundant in earth crust than ^{16}C
 (C) The difference between the physical and chemical atomic masses got narrowed down significantly
 (D) ^{12}C is situated midway between metals and non-metals in the periodic table.
 (E) None of these.
16. Electric cookers have a coating that protects them against fire. The coating is made of
 (A) Magnesium oxide (B) Heavy lead (C) Chromium oxide
 (D) Nickel (E) None of these.
17.  is
 (A) Aromatic compound (B) Annulene
 (C) Heterocyclic compound (D) Polycyclic compound (E) None of these.
18. Atom may be regarded as comprising of protons, neutrons and electrons. If the mass attributed to a neutron were halved and that attributed to the electron were doubled, the atomic mass of ${}^6_6\text{C}^{12}$ would
 (A) Remain approximately the same (B) Be approximately doubled
 (C) Be approximately halved (D) Be reduced approximately by 25% (E) None of these.
19. The chemistry of lithium is very much similar to that of magnesium even though they are placed in different groups. The reason is
 (A) Both have nearly the same size (B) The ratio of their charge to size is nearly the same
 (C) Both have similar electronic configuration
 (D) Both are found together in nature (E) None of these.
20. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends, the white ammonium chloride ring first formed will be
 (A) At the centre of the tube (B) Near the hydrogen chloride bottle
 (C) Near the ammonium bottle (D) Throughout the length of the tube (E) None of these.

ANSWER KEY

MATHEMATICS	:	1.	(A)	2.	(D)	3.	(D)	4.	(C)						
BIOLOGY	:	1.	(A)	2.	(B)	3.	(D)	4.	(A)						
PHYSICS & CHEMISTRY	:	5.	(B)	6.	(B)	7.	(B)	8.	(B)	9.	(C)	10.	(B)	11.	(C)
12.	(A)	13.	(D)	14.	(B)	15.	(C)	16.	(A)	17.	(B)	18.	(D)	19.	(B)
20.	(B)														